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Yoshitaka NAKAJIMA, et al.
Attorney Docket No. 07241.0046

ANNEXES TO THE

PRELIMINARY EXAMINATION REPORT

(ARTICLE 34 AMENDMENTS)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

REQUEST FOR SUBSTITUTION OF REPLACEMENT SHEETS

Please substitute the attached replacement sheets 1, 11, 15, 15-1, 16, and 16-1 containing the Article 34 Amendments for sheets 1, 11, 15, and 16 of the specification in the enclosed as-filed PCT application and replacement sheets 41, 42, 43, 44, and 45 of the claims containing the Article 34 Amendments for sheets 41, 42, 43, 44, and 45 of the claims in the enclosed as-filed PCT application. Claims 1-15 as set forth in the accompanying Replacement Sheets are currently pending.

Respectfully submitted,

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Dated: June 30, 2006

By: _____
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EFC/FPD/rac

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REPLACEMENT SHEETS

- Amendment filed on August 15, 2005
pursuant to Article 34 PCT -

SPECIFICATION

FLESH CONDUCTED SOUND MICROPHONE, SIGNAL PROCESSING DEVICE, COMMUNICATION INTERFACE SYSTEM AND SOUND SAMPLING METHOD

Technical Field

The present invention relates to a microphone, a signal processing device, a communication interface system and a sound sampling method, and more particularly to a microphone for sampling vibratory sounds which result from the conduction of non-audible respiratory sounds of infinitesimal quantities (the quantity of expiration and that of inspiration) by soft tissues in the body (such as flesh) (hereinafter referred to as "flesh-conduction") not involving regular vibrations of the vocal cords articulated by variations in resonance filter characteristics accompanying the motions of phonatory organs and not intended to be heard by persons around (hereinafter referred to as "non-audible murmur" (NAM)) and a signal processing device, a communication interface system and a sound sampling method using it.

Background Art

The rapidly spreading use of mobile telephones has given rise to problems of call manner in the means of public transport, such as trains and buses. Mobile telephones are the same in basic structure of interface as analog telephones of the past; since they sample air-conducted voices, speaking over a mobile

the interface between the skin surface over soft tissues in the body, which are mainly liquid, and the air space, which is gaseous, and obtain the spectrum of bands at or above 2 kHz.

Disclosure of the Invention

A microphone according to the present invention is installed on a surface of the skin on the sternocleidomastoid muscle immediately below the mastoid of the skull, that is, in the lower part of the skin behind the auricle, intended to sample at least one of a non-audible murmur articulated by a variation resonance filter characteristics associated with motion of the phonatoroy organ, the non-audible murmur not involving regular vibration of the vocal cords, the non-audible murmur being a vibration sound generated when an externally non-audible respiratory sound is transmitted through internal soft tissues, a whisper which is audible but is uttered without regularly vibrating the vocal cords, a sound uttered by regularly vibrating the vocal cords and including a low voice and a murmur, and inputting speech such as a teeth gnashing sound and a tongue clucking sound. The microphone comprises a condenser microphone portion having a pair of diaphragm electrodes and a contact portion which has an acoustic impedance close to the acoustic impedance of soft tissues in the body, is stuck tightly to the condenser microphone portion with no intervening air space and conducts the input speech from the skin surface to the condenser microphone. Such a configuration makes it possible to restrain attenuation of

which is audible but is uttered without regularly vibrating the vocal cords, a sound uttered by regularly vibrating the vocal cords and including a low voice and a murmur, and input speech such as a teeth gnashing sound and a tongue clucking sounds, the microphone comprising a condenser microphone portion having a pair of diaphragm electrodes and a contact portion which has an acoustic impedance close to the acoustic impedance of soft tissues in the body, is stuck tightly to the condenser microphone portion with no intervening air space and conducts the input speech from the skin surface to the condenser microphone. The use of such a signal processing device makes it possible to restrain attenuation of the high frequency region attributable to mismatching of acoustic impedance.

A communication interface system according to the present invention is characterized in that it uses for communication the result of signal processing by the signal processing device described above. The use of such a communication interface system enables communication to be performed while restraining attenuation of the high frequency region attributable to mismatching of acoustic impedance.

A sound sampling method according to the present invention by which a microphone samples at least one of a non-audible murmur articulated by a variation in resonance filter characteristics associated with motion of the phonatory organ, the non-audible murmur not involving regular vibration of the vocal cord, the non-audible murmur being a vibration sound generated when an externally non-audible respiratory sound

is transmitted through internal soft tissues, a whisper which is audible but is uttered without regularly vibrating the vocal

cords, a sound uttered by regularly vibrating the vocal cords and including a low voice and a murmur, and input speech such as a teeth gnashing sound and a tongue clucking sound, comprising:

the microphone

causes the input speech to be conducted from the skin surface to a condenser microphone having a pair of diaphragm electrodes and stuck tightly to the condenser microphone portion with no intervening air space via a contact portion whose acoustic impedance is matched to an acoustic impedance close to the acoustic impedance of soft tissues in the body, and

is installed on a surface of the skin on the sternocleidomastoid muscle immediately below the mastoid of the skull, that is, in the lower part of the skin behind the auricle. The use of such a sound sampling method makes it possible to restrain attenuation of the high frequency region attributable to mismatching of acoustic impedance.

In short, the present invention concerns use of non-audible murmurs for communication. Non-audible murmurs uttered without regular vibrations of the vocal cords are articulated by a variation in resonance filter characteristics associated with motions of articulatory organs including the tongue, lips, jaw and soft palate substantially similarly to normal speech uttered by regularly vibrating the vocal cords, and undergo flesh-conduction.

According to the present invention, the microphone is fitted in tight adherence immediately below the

sternocleidomastoid muscle. When amplifying the muscle-conducted vibratory sounds of non-audible murmurs are

REPLACEMENT SHEET

Amended Claims

under Art. 34 PCT

1. (Amended) A microphone to be installed on a surface of the skin on the sternocleidomastoid muscle immediately below the mastoid of the skull, that is, in the lower part of the skin behind the auricle, intended to sample at least one of a non-audible murmur articulated by a variation in resonance filter characteristics associated with motion of the phonatory organ, the non-audible murmur not involving regular vibration of the vocal cords, the non-audible murmur being a vibration sound generated when an externally non-audible respiratory sound is transmitted through internal soft tissues, a whisper which is audible but is uttered without regularly vibrating the vocal cords, a sound uttered by regularly vibrating the vocal cords and including a low voice and a murmur, and input speech such as a teeth gnashing sound and a tongue clucking sound, the microphone comprising a condenser microphone portion having a pair of diaphragm electrodes and a contact portion which has an acoustic impedance close to the acoustic impedance of soft tissues in the body, is stuck tightly to said condenser microphone portion with no intervening air space and conducts said input speech from said skin surface to said condenser microphone.

2. The microphone according to Claim 1, wherein said contact portion is formed of hardened silicone rubber.

3. The microphone according to Claim 2, wherein said hardened silicone rubber not only covers said condenser microphone portion but also fills the whole inside of the microphone.

4. The microphone according to Claim 2 or Claim 3, wherein the hardness of said hardened silicone rubber is not higher than 30 (Shore A).

5. The microphone according to Claim 2 or Claim 3, wherein said hardened silicone rubber is addition reaction-setting organo-polysiloxane, silica fine powder is 10 to 60 weight parts, and organo-hydrogen polysiloxane is 1 to 60 weight parts.

6. The microphone according to any of Claim 1 through Claim 5, wherein the shape of said contact portion is such that the sectional area thereof becomes gradually smaller from said condenser microphone portion toward said skin surface.

7. The microphone according to any of Claim 1 through Claim 5, wherein the shape of said contact portion is such that the sectional area thereof becomes gradually larger from said condenser microphone portion toward said skin surface.

8. The microphone according to any of Claim 1 through Claim 7, wherein said condenser microphone portion is disposed submerged in said contact portion.

9. The microphone according to Claim 8, further comprising a reinforcing portion which is harder than said contact portion and covers other parts than the face of the contact portion coming into contact with said skin surface, and a reflector which is disposed on the interface between said contact portion and said reinforcing portion and reflects said non-audible murmurs.

10. The microphone according to Claim 9, wherein said condenser microphone portion is turned upside down.

11. The microphone according to Claim 10, wherein said reflector has a parabolic shape, namely a shape following a parabola.

12. The microphone according to any of Claim 1 through Claim 11, wherein it is configured integrally with a head wearing object to be fitted to the head of a human, such as spectacles, headphones, an earphone, a cap or a helmet.

13. (Amended) A signal processing device which subjects to signal processing input signals from a microphone to be installed on a surface of the skin on the sternocleidomastoid muscle immediately below the mastoid of the skull, that is, in the lower part of the skin behind the auricle, intended to sample at least one of a non-audible murmur articulated by a variation in resonance filter characteristics associated

with motion of the phonatory organ, the non-audible murmur not involving regular vibration of the vocal cords, the non-audible murmur being a vibration sound generated when an externally non-audible respiratory sound is transmitted through internal soft tissues, a whisper which is audible but is uttered without regularly vibrating the vocal cords, a sound uttered by regularly vibrating the vocal cords and including a low voice and a murmur, and input speech such as a teeth gnashing sound and a tongue clucking sound, the microphone comprising a condenser microphone portion having a pair of diaphragm electrodes and a contact portion which has an acoustic impedance close to the acoustic impedance of soft tissues in the body, is stuck tightly to said condenser microphone portion with no intervening air space and conducts said input speech from said skin surface to said condenser microphone.

14. A communication interface system wherein it uses for communication the result of signal processing by the signal processing device according to Claim 13.

15. (Amended) A sound sampling method by which a microphone samples at least one of a non-audible murmur articulated by a variation in resonance filter characteristics associated with motion of the phonatory organ, the non-audible murmur not involving regular vibration of the vocal cords, the non-audible murmur being a vibration sound generated when an externally non-audible respiratory sound is transmitted

through internal soft tissues, a whisper which is audible but is uttered without regularly vibrating the vocal cords, a sound uttered by regularly vibrating the vocal cords and including a low voice and a murmur, and input speech such as a teeth gnashing sound and a tongue clucking sound, comprising:

said microphone

causes said input speech to be conducted from said skin surface to a condenser microphone having a pair of diaphragm electrodes and stuck tightly to said condenser microphone portion with no intervening air space via a contact portion whose acoustic impedance is matched to an acoustic impedance close to the acoustic impedance of soft tissues in the body, and

is installed on a surface of the skin on the sternocleidomastoid muscle immediately below the mastoid of the skull, that is, in the lower part of the skin behind the auricle.